METHOD FOR RECORDING STREAM SPECIFIC INFORMATION IN A DISK AND PROVIDING THE RECORDED INFORMATION

BACKGROUND OF THE INVENTION

1. Field of the Invention

5   The present invention relates to an optical disk and method for recording program or stream specific information (PSI or SSI) for recorded data stream in an optical disk such as a high-density digital versatile disk (HD-DVD) and providing the recorded PSI or SSI to a presenting device such as a digital

10 television.

2. Description of the Related Art

A digital television which can receive digital broadcast programs and present them as high-quality picture and sound is being popularized. The digital broadcast signal to be processed

15 in the digital television contains PSI for various programs and data presentation control as well as digital video and audio signal. It is specified that the PSI should be intermittently inserted in the data stream of the digital broadcast signal.

Therefore, the digital television interprets the PSI

20 received intermittently, and selects a program contained in the

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data stream and decodes data belonging to the selected program based on the PSI interpretation.

In the meantime, a disk device which is being developed to reproduce a high-density digital versatile disk (HD-DVD) whose recording standard is under discussion, is expected to be connected with a digital television as shown FIG. 1 through IEEE 1394 standard. The digital television 500 still requires PSI to select a program and to control data presentation when receiving and presenting the data stream from the disk device 100.

a2> Therefore, when reproducing MPEG-formatted data stream recorded in a HD-DVD and sends it to the digital television 500 connected through a digital interface such as IEEE 1394 standard, the disk device 100 should provide PSI, which consists of a program association table (PAT), a program map table (PMT), a conditional access table (CAT), and so on as shown in FIG.2, to the digital television 500 in the format of a transport stream (TS) consisting of 188-byte-long transport packets (TPs).

a3> To provide PSI for recorded data stream to the digital television, which is connected through a digital interface such as IEEE 1394 standard, intermittently and periodically as in a digital broadcast signal, it may be considered that PSI is recorded dispersedly and repeatedly in a data recording area 'AREA 1' of a HD-DVD as shown in FIG. 3, and it is retrieved and transmitted sequentially along with data stream.

a4> However, if PSI is recorded dispersedly and repeatedly in a data recording area of a disk, the recording area for real data, that is, video and/or audio data is greatly reduced, which causes to decrease a recording efficiency of a disk.

a5> In addition, the digital television should wait for receiving one in regular sequence among the PSI recorded dispersedly in the data recording area to present received data stream even though data receiving has been resumed after a

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reproduction point is moved according to a key command of a user or the digital interface such as IEEE 1394 standard is reset. Since the digital television can not select data stream to decode into real picture and/or sound until the PSI for the data

5 stream is received, there is inevitably discontinuity in video and/or audio or blank screen for a while.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an optical disk containing PSI in its management recording area

10 and a method for recording PSI in an optical disk and providing the recorded PSI to a digital television, which records PSI for the recorded data stream in a specific area where management information for the recorded real data is written and, if it is time to send PSI, searches and reads PSI written in the

15 specific area to a digital television.

A method of recording stream specific information along with data stream in a disk according to the present invention, checks whether stream specific information requires to be changed while recording the data stream in the disk, generates

20 stream specific information adequate to the data stream being recorded based on the checked result, and writes the generated stream specific information and an additional information, which consists of start and/or end position data of a related stream object, to link the stream specific information with a

25 stream object.

A method of providing data stream and stream specific information recorded in a disk according to the present invention, determines whether it is the time to send stream specific information, obtains stream specific information

30 related with a stream object being reproduced or to be reproduced based on the determination result, and transmits the obtained stream specific information, . wherein the stream

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objects have different contents of stream specific information each other.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide
a further understanding of the invention, illustrate the
preferred embodiments of the invention, and together with the
description, serve to explain the principles of the present
invention.

In the drawings:

FIG. 1 shows a digital television and a high-density disk
reproducing device which are connected each other;

FIG. 2 shows partial contents of program specific
information;

FIG. 3 shows partitioned recording areas and contents to
be recorded thereon;

FIG. 4 is a block diagram of a disk device to which a data
stream recording method according to the present invention is
applied;

FIG. 5 shows partitioned recording areas and contents to
be recorded thereon according to the present invention;

FIG. 6 is a block diagram of a disk device to which a data
stream reproducing method according to the present invention
is applied;

FIG. 7 shows a flow diagram of method for providing stream
specific information according to the present invention; and

FIG. 8 shows an example of when to transmit stream specific
information

DETAILED DESCRIPTION OF THE PREFFERRED EMBODIMENTS

In order that the invention may be fully understood,
preferred embodiments thereof will now be described with

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reference to the accompanying drawings.

FIG. 4 is a partial block diagram of a disk device, which a PSI-recording method according to the present invention is applied to, for recording data in a high density disk.

5 The disk device of FIG. 4 comprises a PSI separator 21 separating PSI contained in the received broadcast signal; a signal processor 22 processing the received digital broadcast signal, which the PSI is separated from, into a digital stream adequate to recording format; a PSI processor 23 processing the 10 separated PSI into a digital stream adequate to recording format; a signal selector 24 selecting one among the broadcast digital stream and the PSI stream; a pickup 27 writing the stream selected by the signal selector 24 in a high-density disk 28; a microcomputer 25 controlling the overall recording operation; 15 and a memory 26 for storing data necessary for control operation of the microcomputer 25.

The recording operation of the disk device 200 configured as above is described in detail.

The PSI separator 21 detects PSI, which consists of PAT, 20 PMT, CAT, and so on as explained above referring to FIG. 2, contained intermittently in digital broadcast signal, and separates it from the received digital broadcast signal. The PSI processor 23 processes the separated PSI into a digital stream adequate to recording format of a high-density 25 rewritable digital versatile disk (HD-DVD RAM), and the microcomputer 25 compares the separated PSI with PSI detected before to know whether the separated PSI is new, that is, the separated PSI contains data which is different from the data of the previous PSI. If the separated PSI is new, it is written 30 in the high-density disk 28 under control of the microcomputer 25 after being processed by the PSI processor 23.

When the PSI is processed by the PSI processor 23, control information may be appended to the PSI or the PSI is modified

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for various presentation appropriate to a data stream reproduced from a disk device. The modified PSI or control information appended PSI is called stream specific information (SSI).

5   The recording area where the PSI is written is a management information recording area where navigation data is written. The navigation data is used for controlling reproduction and presentation of recorded broadcast data containing video and/or audio data stream processed by the signal processor 22. When

10 writing PSI (or SSI), the microcomputer 25 generates linking information between the written PSI (or SSI) and a stream object, and appends the generated linking information to the written PSI (or SSI). A stream object corresponds to a single program or a digital stream recorded from recording start to stop, and

15 the linking information consists of start and end time of each stream object.

     All of PSI (or SSI) including the linking information for stream objects, each stream object having different specific information for its own data stream, is written in the

20 management information recording area.

     In the meantime, the high-density disk 28 has two partitioned recording areas 'AREA 1' and 'AREA 2' as shown in FIG. 5, the one 'AREA 1' being for real data such as video and/or audio data which is grouped by stream object, the other 'AREA

25 2' being for management information such as navigation data which is used for controlling reproduction and presentation of recorded stream objects. As explained above, the detected PSI, which will be transmitted to a digital television connected through a digital interface such as IEEE 1394 to select a data

30 stream from the disk device and to decode the selected stream, is also written in the management information recording area 'AREA 2'.

     Since PSI (or SSI) is written in the management

information recording area 'AREA 2', the storage capacity of the data recording area 'AREA 1' is not reduced.

[A14] From now on, a method of reproducing data stream ~~and~~ specific information from the disk having PSI (or SSI) written

5 only in the management information recording area 'AREA 2' and providing them ~~to~~ a digital television will be described.

FIG. 6 is a block diagram of a disk device to conduct the method of reproducing and providing data stream and specific information according to the present invention.

10 The disk device 300 shown in FIG. 6 comprises an optical pickup 32 detecting recorded signals of a high-density disk 31 having PSI (or SSI) written in the area 'AREA 2'; an analog signal processor 33 processing the electrical signal from the pickup 32 to convert it into a binary signal; a digital signal processor

15 34 processing the binary signal to obtain real data and PSI (or SSI); a TS multiplexer 35 multiplexing the real data and PSI (or SSI) and converting the multiplexed data into TS; an interfacing unit 36 transmitting the TS to a digital television 500 connected through IEEE 1394 standard; a microcomputer 37

20 supervising the overall reproduction operation; and a memory 36 for storing data necessary for control operation of the microcomputer 37.

[A15] The microcomputer 37 conducts an operation to provide PSI (or SSI), which is corresponding to the present data stream

25 being reproduced to be reproduced, to the digital television 500. To do so, it reads from the management information recording area 'AREA 2' when a key command directly from a user is entered, a packet command from the digital television 500 connected through IEEE 1394 standard is received, or there

30 occurs a bus reset on the IEEE 1394. Then, the digital television 500 interprets the PSI (or SSI) received through the IEEE 1394 bus, and selects and decodes a data stream based on the interpretation of the PSI (or SSI).

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FIG. 7 is a flow diagram of sending PSI (or SSI) to a digital television according to the present invention. The PSI (or SSI) sending procedure to be conducted by the disk device 300 is described in detail referring to FIG. 7.

5   If the disk 31 having PSI (or SSI) written in the management information recording area is inserted onto a tray (not figured) of the disk device 300 (S10), the microcomputer 37 moves the pickup 32 to the management information recording area 'AREA 2' to read navigation data and PSI (or SSI), and stores

10   them in the memory 38 (S11).

      a \6⟩ After that, the microcomputer 37 monitors (S12) the operation mode of the disk device 300 and the digital television 500 connected through IEEE 1394 standard as well as whether there occurs a bus reset on the digital interface of IEEE 1394.

15   If the operation mode of the disk device 300 is reproduction mode (S13) in which a data stream recorded in the disk is or to be reproduced and transmitted in the form of TS, the microcomputer 37 checks whether a transmission operation of TS is first (S14), if then, it searches the memory 38 for PSI (or

20   SSI) corresponding to a stream object to be reproduced based on the linking information appended to all of PSI (or SSI) and applies the adequate PSI (or SSI) to the TS multiplexer 35 along with real data stream reproduced from the data recording area 'AREA 1' of the disk 31.

25   The TS multiplexer 35 multiplexes the PSI (or SSI) and real data stream while converting them into TS consisting of stream information packets (SIPs) and data packets, and transmits the converted TS to the connected digital television 500 through the interfacing unit 36.

30   The SIP may be transmitted more than once to prevent from accident loss in communication channel before sending real data packets, and it may contain time reference information such as program clock reference (PCR) to be used to synchronize an

internal clock beforehand for timing control of data presentation in the digital television 500.

(17) The SIP may be 188-byte long as specified for a transport packet (TP) in digital broadcast standard, and it may be

5 transmitted repeatedly every 40 msec as shown in FIG. 8.

(18) If a data stream of new program starts to be transmitted, that is, new stream object starts to be reproduced (S15) while a data stream being reproduced from the high-density disk 31 is being transmitted in the format of TS, the microcomputer 37

10 also searches the memory 38 for PSI (or SSI) corresponding to the new stream object to be reproduced and applies the adequate PSI (or SSI) to the TS multiplexer 35 along with real data stream belonging to the new stream object which is reproduced from the data recording area 'AREA 1' of the disk 31.

15 (19) For example, If the start position information of the (N+1)-th stream object is detected after the N-th stream object is completely reproduced as shown in FIG. 8 while reproducing the disk 31, the microcomputer 37 reads the PSI (or SSI) related with the (N+1)-th stream object from the memory 38 and then

20 applies the read PSI (or SSI) to the TS multiplexer 35. In other words, the microcomputer 37 searches for PSI (or SSI) related with each stream object being provided to the digital television 500 at present based on the linking information and applies the found PSI (or SSI) to the TS multiplexer 35.

25   Therefore, the TS multiplexer 35 multiplexes the PSI (or SSI) and real data stream of the present stream object (S20) while converting them into TS consisting of stream information packets and data packets, and transmits the converted TS to the connected digital television 500 through the interfacing unit

30 36 (S21).

(20) And, if the microcomputer 37 conducts a long jump of the pickup 32 according to a key input from a user (S16), it searches the memory 38 for PSI (or SSI) corresponding to the new or same

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stream object to be reproduced after the long jump, and applies the adequate PSI (or SSI) to the TS multiplexer 35 along with real data stream belonging to the stream object to which the pickup 32 is moved.

5   Then, the TS multiplexer 35 multiplexes the PSI (or SSI) and real data stream while converting them into TS consisting of stream information packets and data packets (S20), and transmits the converted TS to the connected digital television 500 through the interfacing unit 36 (S21).

10   And, if the digital television 500 connected with the disk device 300 through the IEEE 1394 standard is turned on (S17) or its viewing channel is changed (S18), a corresponding command is sent to the microprocessor 37 of the disk device 300 through the digital interface. At this time, the microcomputer 37 reads

15 PSI (or SSI) related with stream object being or to be provided on request of disk reproduction to the digital television 500, and applies the adequate PSI (or SSI) to the TS multiplexer 35 along with real data stream, if it is in a reproducing mode at present.

20   Then, as explained above, the TS multiplexer 35 multiplexes the PSI (or SSI) and real data stream, if it is applied, while converting them into TS consisting of stream information packets and data packets (S20), and transmits the converted TS to the connected digital television 500 through

25 the interfacing unit 36 (S21).

     Furthermore, if there occurs a reset on the IEEE 1394 digital interface (S19), the microcomputer 37 detects the reset while monitoring the status of the digital interfacing bus, reads again PSI (or SSI) related with stream object being or

30 to be provided to the digital television 500, and applies the adequate PSI (or SSI) to the TS multiplexer 35 along with real data stream, if it is in a reproducing mode at present.

     Then, the TS multiplexer 35 multiplexes the PSI (or SSI)

and real data stream, if it is applied, while converting them into TS consisting of stream information packets and data packets (S20), and transmits the converted TS to the connected digital television 500 through the interfacing unit 36 (S21).

5   The above-explained operations (S12 to S22) is conducted by the microcomputer 37 until the disk device 300 is turned off or is requested to stop.

(23) To be brief, whenever there is a command from a user or the digital television 500 connected through IEEE 1394, or there 10 occurs a reset on the interface bus, the disk device 300 reads the stored PSI (or SSI), which was reproduced beforehand from the management information recording area 'AREA 2' of the high-density disk 31, and then provides the read PSI (or SSI) to the connected digital television 500, so that the digital 15 television 500 can select and decode the data stream from the disk device 300 immediately after the interpretation of the PSI (or SSI) is done.

(24) The method of providing specific information on a data stream according to the present invention can maintain the disk 20 storage capacity for real video and/or audio data by recording stream specific information in a management recording area of a high-density disk, and provide the stream specific information to a digital television promptly when it is necessary, thereby reducing time of blank screen or 25 discontinuity in video and/or audio presentation.

The invention may be embodied in other specific forms without departing from the sprit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope 30 of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.